# Public Policy and Market Competition: How the Master Settlement Agreement Changed the Cigarette Industry

*Berkeley Electronic Journal of Economic Analysis and Policy: Advances*

SUPPLEMENTAL APPENDIX

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**May 2010**

**Abstract**

This appendix presents additional background on the Master Settlement Agreement and robustness checks on the results reported in the article. Section 1 provides institutional details on the cigarette industry and illustrates in detail how the Master Settlement Agreement transforms the lump-sum payments into an effective per-pack tax. Section 2 presents the results from additional specifications of the instrumental variables model.

# 1. Institutional Analysis of the Cigarette Industry

## 1.1. Market Structure of the Cigarette Industry

The cigarette industry is highly concentrated. Until very recently Philip Morris (PM), RJ Reynolds (RJR), Brown & Williamson (B&W), and Lorillard controlled virtually all of the market (98.6% in 1997).[1] The next largest firm, Liggett Group Inc., controlled 1.34% of the market in 1997, and hundreds of small firms together accounted for the remaining one tenth of one percent. Over the last fifteen years the process of consolidation has continued. In April 1995 American Tobacco Company was bought by B&W.[2] In May 1999, Liggett sold the brands L&M, Chesterfield, and Lark to Philip Morris. In October 2003 RJR and B&W announced their intention to merge cigarette businesses, and on June 22, 2004, the Federal Trade Commission cleared the merger. Meanwhile, small manufacturers gained market share, from around 2 percent in 1997 to well over 10 percent in 2003 (FTC 2004).

## 1.2. The 1997 Master Settlement Agreement[3]

In response to increasing legal expenses, Philip Morris, RJ Reynolds, Brown and Williamson, and Lorillard signed a series of agreements between July 1997 and July 1999 with tobacco growers and with the attorneys general from the 50 states. We refer to these agreements collectively as the Master Settlement Agreement, or MSA.[4] The MSA releases participating manufacturers from preexisting and future lawsuits brought against them by the states and tobacco growers. In exchange, the manufacturers agreed to pay billions of dollars of annual lump-sum payments in perpetuity.[5] In the rest of this subsection, we describe the annual payments obligated under the MSA.

The MSA provides for a complex scheme of payments. RJR, PM, B&W, and Lorillard, which are the Original Participating Manufacturers (OPMs), must face "Initial Payments", which are divided according to their respective market

[1] See Bulow and Klemperer (1998).

[2] Through the acquisition of ATC, B&W acquired the cigarette brands Carlton, Lucky Strike, Misty, Tareyton, and Pall Mall.

[3] The full text of the Master Settlement Agreement is available online at: http://www.naag.org

[4] By mid-2003, 40 more companies had signed the agreement, including Liggett. As an incentive to sign, the MSA contains provisions that require each state to extract special payments from manufacturers that have not signed.

[5] The agreements also restrict cigarette advertising and promotion in many ways including a ban on cartoon advertising, limits on sponsorship, and bans on certain types of outdoor advertising. While most of these payments are transferred to the states and to tobacco growers, a small share has been used to establish foundations to reduce youth smoking and to enforce other provisions of the MSA. See Cutler et al. (2002) for a detailed analysis of the agreement.

capitalization percentages in 1997.[6] In 1998, the OPMs incurred $2,400 million in Initial Payments. Initial Payments are due until 2003. In 2003, the final scheduled Initial Payment was for $2,701 million.

**TABLE A1: The Master Settlement Agreement***
**(Payments in millions of dollars)**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Year | States | Florida, Minnesota, Mississippi, Texas | National Public Education Fund | Attorney fees | Tobacco growers | Total Scheduled Payment | Actual Payment | Effective per pack tax (cents) |
| 1997 | | 1,827 | | | | 1,827 | 1,827 | 0 |
| 1998 | 3,080 | 495 | 325 | 500 | | 4,400 | 4,400 | 0 |
| 1999 | 7,737 | 253 | 325 | 500 | 380 | 9,195 | 7,600 | 33 |
| 2000 | 8,396 | 253 | 325 | 500 | 280 | 9,754 | 8,191 | 36 |
| 2001 | 10,228 | 253 | 325 | 500 | 400 | 11,705 | 9,535 | 44 |
| 2002 | 10,306 | 253 | 325 | 500 | 500 | 11,884 | 9,560 | 44 |

* In 1998, Column 3 includes $50 million used to establish the Consumer Protection Tobacco Enforcement Fund.

After 1993, OPMs only face "Annual and Strategic Contribution Payments." These payments are to be made in perpetuity. They were scheduled to increase from $680 million in 1998 to $6,500 million in 2002.[7] Column 1 of Table A1 shows the sum of the Initial and scheduled Annual and Strategic Contribution Payments between 1997 and 2002 for 46 states. Column 2 reports the payments to four other states that signed prior agreements with the OPMs.[8]

As part of the MSA, payments are made to a charitable foundation, trust or similar organization (the "Foundation") and/or to a program to be operated within the Foundation (the "National Public Education Fund"), whose purpose is to reduce youth tobacco product usage and youth substance abuse in the settling

[6] The MSA distinguishes between three types of cigarette manufacturers. In addition to the OPMs, there are the Subsequent Participating Manufacturers (SPMs), which are firms that have become parties of the MSA after 1998. Liggett is one of the SPMs. Finally, there are the Non-Participating Manufacturers (NPM), which are firms that elected not to sign the MSA. We do not investigate the strategic implications of the decision to be an SPM or an NPM.

[7] Afterwards, the payments are scheduled to be $8 billion for 2003-2006, $8.1 billion for 2007-2016, and $9 billion permanently after 2017.

[8] The first four settlements, between July 1997 and May 1998 were signed with Florida, Minnesota, Mississippi and Texas. Mississippi settled on July 7, 1997; Florida settled on August 25, 1997; Texas settled on January 16, 1998; and Minnesota settled on May 8, 1998. After these initial state settlements, the cigarette companies signed the Master Settlement Agreement (MSA) with the remaining 46 states on November 23, 1998. For practical purposes, the four states settlements provide for payments that follow the same scheme as the MSA.

states.[9] Column 3 of Table A1 shows that the total payments made for the Foundation. The OPMs must also pay the fees for the states' attorneys. These fees are equal to $500 million per year between 1998-2002 (see Column 4 of Table A1).

After the implementation of the MSA, tobacco growers and tobacco quota owners brought a lawsuit against the signatories of the MSA for conspiring with the district attorneys to reduce purchases of American tobacco. The result was that Philip Morris, RJR, Brown and Williamson, and Lorillard signed an additional agreement with 14 tobacco growing states on July 19, 1999. The agreement created the National Tobacco Grower Settlement Trust to pay tobacco growers and quota owners $5.15 billion between 1999 and 2010.[10] The agreement is commonly referred to as "Phase II" of the tobacco settlement. Column 5 of Table A1 shows the yearly payments for 1999-2002.

The scheduled payments presented in Columns 1 and 5 of Table A1 are adjusted on a yearly basis to account for inflation, for a potential decrease in the total number of cigarettes sold, and for a potential increase in the market shares of non participating manufacturers.[11,12] The volume adjustment is based on the volume of cigarettes sold in the United States. If this amount declines, then total payments decline. In particular, the payment after reduction is a fraction of the scheduled payment. Overall, the actual MSA payments (Column 7) have been substantially lower than their scheduled levels (Column 6) due primarily to the volume adjustment. We discuss this adjustment in the next subsection.[13]

### 1.3. The MSA Payments as a Unit Tax

The *volume adjustment* transforms the payments from a lump sum into an effective per/pack tax. The adjustment gives firms an incentive to raise prices in order to decrease the size of MSA payments. To see this, consider equation (1) which shows how the annual industry-wide payment in year $t$ depends on the volume adjustment.

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[9] There are two types of payments to this end: base payments, which are not subject to any adjustment; and additional payments, which are subject to the same adjustments (described below) as the Initial and Annual payments. The base payments started on March 31, 1999, and will continue for nine years. The additional payments continue until 2003.

[10] The Phase II payments to the Tobacco Growers continue to be $500 million during 2003-2008, before decreasing to $295 million in 2009 and 2010, and then terminating.

[11] The inflation adjustment increases the payments by 3% or by the percentage increase in the Consumer Price Index for the preceding year, whichever is greater. Since inflation has stayed well below 3%, the payments have increased by 3% annually since the signing of the MSA.

[12] Payments by OPMs and SPMs are adjusted downward if they lose more than 2% of total market share to NPMs in any year. We compute the following reductions to the annual and strategic contribution payments: $51.4 million in 2000; $200.5 million in 2001; and $342.5 million in 2002.

[13] Using cigarette sales data from the Federal Trade Commission, we calculate the volume adjustment reduction as 4% in 1998; 13.7% in 1999; 13.2% in 2000; and 16.4% in 2001 (FTC 2001).

Equation (A1) shows firm *f*'s single-period profit function, where $\tau$ represents the sum of state and federal taxes and *mc* is marginal cost. The *s* subscript on price reflects the fact that restrictions on interstate trade allow firms to choose prices in each state independently.

$$\Pi_t^f = \sum_s \left(P_{st}^f - mc_t^f - \tau_{st}\right)Q_{st}^f - \overline{MSA_t}\left(\sum_s Q_{st}^f \Big/ \sum_s Q_{st}\right). \quad \text{(A1)}$$

Substituting the expression for $\overline{MSA_t}$ from equation (1) into (A1), solving the usual first order condition, and rearranging terms allows the firm's profit-maximizing price to be expressed as a function of marginal cost, taxes, the demand elasticity ($\eta$), the baseline level of scheduled payments, and sales made by the firm and its competitors.[14]

$$P_{st}^f = \frac{\eta_{st}^f}{\eta_{st}^f + 1}\left\{mc_t^f + \tau_{st} + \left(\frac{.98(a_t)MSA_t}{Q_{1997}}\right) + (1 - .98a_t)\frac{MSA_t}{Q_t}\left[1 - \frac{Q_t^f}{Q_t}\left(\frac{\partial Q_{st}}{\partial P_{st}^f} \Big/ \frac{\partial Q_{st}^f}{\partial P_{st}^f}\right)\right]\right\} \quad \text{(A2)}$$

In equation (A2), the last two terms in {} depict the incentives created by the structure of the MSA. The last term represents the firm's strategic incentive to decrease its share of the MSA payments that are not subject to the volume adjustment by raising its price. This term will be small compared to the other terms in {}. To see why, notice that as long as an increase in the price charged by firm *f* does not <u>increase</u> total industry sales, the term in [] cannot exceed 1. In the extreme case where []=1, the last term in {} would have been about 7 cents during 2002.[15] This figure reflects an upper bound; ceteris paribus, it will decrease as the firm's market share increases. The third term in {} arises because of the volume adjustment—by raising its prices, a firm decreases the volume of its sales, and therefore the size of its payment. This constant term is equal to ninety-eight percent of scheduled payments subject to the volume adjustment in year *t*, divided by baseline sales. In 2002, this effective tax was equal to 44 cents per pack.

## 2. Robustness Checks on the Baseline Parameter Estimates

Table A2 reports the results from alternative specifications of the instrumental variables model from Table 4 in the paper. These models serve as robustness checks on our baseline results.

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[14] While we treat the demand elasticity as constant for simplicity here, our structural model recognizes that the demand elasticity may be a function of price.

[15] In 2002, $a_t$ = 0.91, $MSA_t$=11.88 billion, and Qt=19.5 billion. Thus, we have (1-.98*.91)(.61)[1] ≈ 0.066. In 2008 and thereafter, $a_t$=1.

## TABLE A2: Additional Estimation Results

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $Price_t$ | -0.679 | -0.809 | -0.796 | -0.877 | -0.601 |
| | (0.022) | (0.029) | (0.025) | (0.046) | (0.024) |
| $Eprice_{t+1}$ | -0.147 | -0.041 | -0.040 | -0.079 | -0.103 |
| | (0.032) | (0.035) | (0.033) | (0.030) | (0.033) |
| Menthol | -0.659 | -0.664 | -0.659 | -0.661 | -0.656 |
| | (0.018) | (0.018) | (0.018) | (0.018) | (0.017) |
| Light | 0.148 | 0.293 | 0.147 | 0.148 | 0.145 |
| | (0.017) | (0.041) | (0.017) | (0.017) | (0.016) |
| Length100 | -0.090 | -0.109 | -0.089 | -0.088 | -0.091 |
| | (0.017) | (0.019) | (0.017) | (0.017) | (0.016) |
| Carton | -1.850 | -1.882 | -1.876 | -1.893 | -1.833 |
| | (0.015) | (0.016) | (0.016) | (0.018) | (0.014) |
| $A_{it}$ | | | | | 1.212 |
| | | | | | (0.746) |
| Nicotine | | 0.462 | | | |
| | | (0.145) | | | |
| Tar | | 0.003 | | | |
| | | (0.014) | | | |
| Carbon Monoxide | | -0.012 | | | |
| | | (0.009) | | | |
| After 1999 | | | | 0.139 | |
| | | | | (0.045) | |
| IV | ~ | ~,* | ~,*,^ | *,# | ~,* |
| Discount rate ($\delta$) | n.a. | n.a. | n.a. | n.a. | 0.8 |
| Brand Dummy Variables | yes | yes | yes | yes | yes |
| R-squared | 0.49 | 0.49 | 0.49 | 0.49 | --- |
| GMM | --- | --- | --- | --- | 122.88 |
| Median Price Elasticity | -1.15 | -1.37 | -1.35 | -1.48 | -1.06 |
| pre-MSA | -1.02 | -1.21 | -1.19 | -1.32 | -0.85 |
| post-MSA | -1.82 | -2.00 | -1.97 | -2.17 | -1.27 |

Note: ~ indicates that the instruments include an indicator variable for the post-MSA period (after 1997). * indicates that the instruments include the sum of tar/nic/co for all packs produced by the firm and the sum of tar/nic/co for all packs produced by competing firms. ^ indicates that the instruments include quarterly gasoline prices. # indicates that the instruments include an indicator variable for the early MSA period before advertising restrictions were implemented (3rd quarter 1997 to 3rd quarter 1998).

Column 1 reports the results from an intermediate IV specification where we add the MSA instrument for future prices, but do not instrument for current period prices. Moving to an IV specification decreases the future price coefficient by an order of magnitude, from -0.018 in Column 3 of Table 4 to -0.147 in column 1 of Table A2, making it highly significant. A negative relationship between current consumption and an expected increase in future prices is consistent with forward looking behavior on the part of consumers. Thus, the MSA instrument delivers results that are consistent with the predictions of rational addiction theory. Likewise, comparing the results from Column 1 of Table A2 with Column 4 in Table 4 reveals that adding basis functions of tar, nicotine, and carbon monoxide as instruments for current price decreases its coefficient by 14%.

Column 2 of Table A2 reports the results from modifying the specification in Column 4 of Table 4 by adding tar, nicotine, and carbon monoxide levels as variables that enter the utility function directly. While tar, nicotine, and carbon monoxide levels are not reported on pack labels, one could argue that consumers have some sensory experience of at least tar and nicotine that might influence their choices. Adding these variables has a minimal effect on the price parameter estimates. It decreases the coefficient on current price from -.77 in Column 4 of Table 4 to -.81 in Column 2 of Table A2. As we would expect, adding tar and nicotine content to the utility function substantially changes the magnitude of the coefficient for the "light" label.

In Column 3 of Table A2, we modify the specification in Column 4 of Table 4 by adding retail gasoline prices as an instrument. The rationale for using gas prices as an instrument is that the large (up to 60%) changes in real gasoline prices over our study period would have had income effects that might influence prices changed by profit-maximizing cigarette firms. The gas price instrument is based on retail price data collected from the Department of Energy for the Midwest region (which includes TN). Adding this instrument decreases the coefficient on current price from -.77 in Column 4 of Table 4 to -0.80 in Column 3 of Table A2.

As we noted in the Section 7 of the article, a potential concern with our dichotomous MSA instrument is that it confounds changes in expectations about future prices with the direct effect on utility of changes in advertising and public health initiatives legislated by the MSA. The incremental nature of the MSA settlement provides an opportunity to test this hypothesis. There was a lag between when the first settlement payments were made (July 1997) and when the agreement on advertising restrictions and public health initiatives was completed (November 1998). With this in mind, we ran an additional IV specification with two indicator variables. The first indicator turns on when the initial settlement payments are made (3rd quarter 1997). The second turns on when the advertising

restrictions and funding for public education become operational (4th quarter 1998). Both indicators enter as explanatory variables during the first stage, but only the second indicator is included in the utility function in the second stage. This produces almost no change in our estimated coefficient on future prices. Results are reported in Column 4 of Table A2. The coefficient on future price decreases from -0.062 to -0.079 relative to Column 4 of Table 4 and the two coefficients are within half a standard error of each other.

Finally, Column 5 of Table A2 reports the results after repeating the estimation in Column 5 of Table 4 using a quarterly discount rate of 0.8.

## 3. Computational Issues

The optimization was done using the canned routines *simulannealbnd* and *fminsearch* in Matlab. For each specification, we started our search from at least 5 starting values. We used 200 simulations for each market. The computational analysis was done at the University of Virginia using general-purpose cluster consisting of 125 nodes, with two AMD Opteron CPUs and 2GB of RAM per node as well as a large-memory cluster consisting of 12 nodes, each containing one 3-GHz Intel dual-core Xeon cpu with 32GB of RAM per node.